

PATENT COOPERATION TREATY

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REC'D 25 JAN 2006

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/FI2004/000612	International filing date (day/month/year) 13-10-2004	Priority date (day/month/year) 15-10-2003
International Patent Classification (IPC) or national classification and IPC See Supplemental Box		
Applicant Laamanen Heikki et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ (sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- | | | |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report |
| <input type="checkbox"/> | Box No. II | Priority |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |

Date of submission of the demand 06-05-2005	Date of completion of this report 12-01-2006
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Sture Elnäs /LR Telephone No. +46 8 782 25 00

Form PCT/IPEA/409 (cover sheet) (April 2005)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000612

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: **Cover sheet**

INTERNATIONAL PATENT CLASSIFICATION (IPC):

H04B 10/00 (2006.01)

H04B 10/02 (2006.01)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000612

Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1 - 15 as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- pages _____ as originally filed/furnished
- pages* _____ as amended (together with any statement) under Article 19
- pages* 16 - 19 received by this Authority on 27-12-2005
- pages* _____ received by this Authority on _____
- ☒ the drawings:
- pages 1 - 6 as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000612

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-8</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-8</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-8</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Reference is made to the following documents:

D1:EP1009156
D2:JP10322460
D3:US6577882
D4:US4525834
D5:DE4217297

The invention is directed towards a method and a system for establishing a plurality of subscriber connections. The problem solved by the invention is an alternative implementation of an optical network termination unit in a fiber-copper hybrid subscriber network when feeding the termination unit from the subscriber end of an optical fiber system.

D1 discloses an embodiment where the subscriber line interface in an optic based telephone network is powered from the subscriber side (parts [0003], especially lines 39-48, [0012]).

D2 describes a subscriber-line termination apparatus that feeds the electric power from the subscriber side (WPI-abstract).

D3 discloses the solution of powering a telecommunications network from at least one subscriber side (column 2, lines 18-28). Power may be supplied from the subscriber side back to a line terminal and the central office. The need for battery backups is eliminated.

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

D4 describes an optical transmission system where the operating power is supplied from the subscriber's end. Individual subscriber lines are powered onto an electro-optical transducer (figure 1), located at the subscriber's premises.

D5 discloses an optical communication system where the power to the subscriber terminal is provided directly from the respective subscriber end. An embodiment is described where the electro-optical converter is powered from the subscriber. Furthermore, it is indicated that a battery back-up may be eliminated (column 1, lines 66-68, column 2, lines 18-26, abstract).

Powering a fiber-copper hybrid network from the subscriber side is well known in the art. This solution is known from, for instance, D1. The technical feature of an independent function of individual subscribers network termination is indicated in the prior art, see for instance D3.

D1 is considered closest in describing the invention according to claims 1 and 6.

The invention according to claims 1 and 6 differs from D1 by stating that the conversion elements are adapted to separate subscribers' information, to operate without being dependent on the state of other subscribers' conversion elements and by using passive optical elements.

The subject-matter of claims 1 and 6 is therefore novel (Article 33(2) PCT).

The problem solved is an alternative way of implementation.

D4 discloses a solution of using passive optical elements and powering individual subscriber lines and elements of a hybrid network from the subscriber side. However, D4 does not teach that the subscriber terminals are adapted as one equipment for a plurality of subscribers.

The solution proposed in claims 1 and 6 of the present application is considered as involving an inventive step

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

(Article 33(3) PCT).

Claims 2-5 and 7-8 are dependent on claims 1 and 6 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

The invention is industrially applicable.

Claims:

1. A method for establishing a plurality of subscriber connections in
5 a digital hybrid subscriber network comprising at least one optical fiber (2), a
plurality of subscriber-specific metallic pair cables (4), and equipment (103) adapting
the at least one optical fiber and the plurality of metallic pair cables to each other so
that the at least one optical fiber goes towards a central site and the plurality of
metallic pair cables goes towards a plurality of subscriber transmission devices (5),
10 whereby (a) each subscriber transmission device is connected to the metallic pair
cable of the respective subscriber at the subscriber end of the metallic pair cable, (b)
the central site is configured to transmit subscriber-specific first information streams
in optical form over the at least one optical fiber (2), and (c) said equipment (103) is
configured to transmit second information streams over the at least one optical fiber
15 (2) to the central site, each second information stream being produced by a respective
subscriber transmission device,
the method comprising the steps of adapting said equipment (103)
- for converting the first information streams received from the at least
one optical fiber into electric form and transmitting each first information stream in
20 electric form over the respective metallic pair cable (4) to the respective subscriber
transmission device (5) and
- for receiving each second information stream in electric format from the
respective metallic pair cable and for converting the received second information
streams into optical form and for transmitting the converted second information
25 streams further over the at least one optical fiber to the central site, and
- for receiving the first information streams in multiplexed form from the
at least one optical fiber (2) and for transmitting the second information streams in
multiplexed form to the at least one optical fiber (2),
characterized by
30 - inserting subscriber-specific conversion elements (105) into said
equipment (103), each conversion element comprising active electronics adapted to
separate each first information stream from other subscribers' first information
streams and to convert each separated first information stream from optical form into

analog electric form, and further to feed each converted first information stream over the respective metallic pair cable (4) to the respective subscriber transmission device (5), and adapted to convert each second information stream transmitted by the respective subscriber transmission device (5) over the respective metallic pair cable

5 (4) from analog electric form into optical form,

- providing said equipment (103) with passive optical elements configured to (i) distribute the first information streams to the conversion element (105) of each subscriber and to (ii) combine the second information streams of all subscribers and to feed the combined second information streams into the at least one
10 optical fiber (2), and

- adapting said conversion elements (105) to operate independently so that each conversion element (105) is capable of operating without being dependent on the state of operation of other subscribers' conversion elements,

whereby the operating power required by the equipment (103) is feedable
15 by supplying the operating power required by each subscriber-specific conversion element through the respective metallic pair cable (4).

2. A method according to claim 1, characterized by adapting each subscriber's transmission device (5) to feed direct electric current into the metallic
20 pair cable of the respective subscriber.

3. A method according to claim 1, characterized by inserting a power-generating element (15) into the subscriber-specific conversion element (105) and adapting said power-generating element (15) to produce operating electric power for
25 the conversion element (105) from the direct electric current fed through the metallic pair cable (4).

4. A method according to claim 1, characterized in that each separated first information stream is converted from digital optical form into analog electric
30 form in the respective conversion element (105).

5. A method according to claim 1, characterized in that each separated first information stream is converted from analog optical form into analog electric form in the respective conversion element (105).

- 5 6. A system for establishing a plurality of subscriber connections, comprising at least one optical fiber (2), a plurality of subscriber-specific metallic pair cables (4), and equipment (103) adapting the at least one optical fiber and the plurality of metallic pair cables to each other so that the at least one optical fiber goes towards a central site and the plurality of metallic pair cables goes towards a plurality
- 10 of subscriber transmission devices (5), whereby each transmission device is connected to the metallic pair cable (4) of the respective subscriber at the subscriber end of the metallic pair cable, the system further comprising
- first transmission elements for transporting subscriber-specific first information streams from the central site over the at least one optical fiber (2) to said
 - 15 equipment (103),
 - second transmission elements for transporting second information streams from said equipment (103) over the at least one optical fiber (2) to the central site, each second information stream being produced by a respective subscriber transmission device,
 - 20 - means for converting the first information streams received from the at least one optical fiber into electric form and for transmitting each first information stream in electric form over the respective metallic pair cable (4) to the respective subscriber transmission device (5),
 - means for receiving each second information stream in electric form
 - 25 from the respective metallic pair cable, for converting each received second information stream into optical form, and for transmitting each converted second information stream further over the at least one optical fiber to the central site, and
 - means for multiplexing the first and second information streams in optical form into the at least one optical fiber (2) in respective transmission
 - 30 directions,
- characterized in that
- said equipment (103) comprises subscriber-specific conversion elements (105) comprising active electronics arranged to separate each first

information stream from other subscribers' first information streams, convert each separated first information stream from optical form into an analog electric form, transmit each converted first information stream over the respective metallic pair cable (4) to the respective subscriber transmission device (5), and to convert each
5 second information stream transmitted by the respective subscriber transmission device (5) over the respective metallic pair cable (4) from analog electric form into optical form,

- said equipment (103) comprises passive optical elements (i) for distributing the first information streams to the conversion element (105) of each
10 subscriber and (ii) for combining the second information streams of all subscribers and for feeding the combined second information streams into the at least one optical fiber (2),

- said conversion elements (105) are configured to operate independently so that each conversion element (105) is capable of operating without being
15 dependent on the state of operation of other subscribers' conversion elements,

- the system further comprises power feeding means for feeding the operating power required by the equipment (103), the power feeding means being configured to supply the operating power required by each subscriber-specific conversion element through the respective metallic pair cable (4).

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7. A method according to claim 6, characterized in that the power feeding means comprise current feeding means in each subscriber transmission device (5), the current feeding means of each subscriber transmission device being configured to feed direct electric current into the respective metallic pair cable (4).

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8. A method according to claim 6, characterized in that a subscriber-specific conversion element (105) contains a power-generating element (15) for producing operating electric power for the respective conversion element (105) from the direct electric current fed through the respective metallic pair cable (4).

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